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Zero Retries is an independent newsletter promoting technological innovation in and adjacent to Amateur Radio, and Amateur Radio as (literally) a license to experiment with and learn about radio technology. Radios are computers - with antennas! Now in its fifth year of publication, with 3200+ subscribers.

About Zero Retries

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Paid Subscribers Update

My thanks to **Ryan Tolboom N2BP** for *renewing* as a **Founding Member Subscriber 0012** to Zero Retries this past week!

Founding members are listed in every issue of Zero Retries!

My thanks to **Prefers to Remain Anonymous 13** for *renewing* as an **Annual Paid Subscriber** to Zero Retries this past week - for a 3rd year!

My thanks to **Prefers to Remain Anonymous 51** for *renewing* as an **Annual Paid Subscriber** to Zero Retries this past week - for a 2nd year!

My thanks to **Don Mertz KJ4MZ** for becoming a *new* **Annual Paid Subscriber** to Zero Retries this past week!

Financial support from Zero Retries readers is a significant vote of support for the continued publication of Zero Retries.

Seven NewTechHams from GRCon 2025!

Please welcome these new (and NewTechHams) Amateur Radio Operators who obtained their US Amateur Radio licenses (or tested for upgrade) at the Volunteer Examiner session at GRCon 2025 in Everett, Washington:

KR4GXQ - Bryan Ward

AK6QE - Timothy Meehan

KM7CIT - Anna Meneely

KD3BWX - Zachary Hicks

KD3BWW - Fredrick Odero

KR4GSV - Christopher Long

WH6HBT - Michael Alldritt

Once again, my Thanks on behalf of GNU Radio / GNU Radio Conference 2025 for the leadership of **Daniel Stevens KL7WM** of the Western Washington Ham Training Team (WWHTT) which provided the Volunteer Examiner testing session at GRCon 2025. *WWHTT was great to work with*.

Mourning Typepad

I spent two full days earlier this week archiving my blogs including my N8GNJ and SuperPacket blogs that were previously hosted on Typepad, which shut down the evening of 2025-09-30.

Typepad was an early and pretty capable blog (and kind-of web page) hosting service, so there are many alternatives now (mostly Wordpress). One unique feature of Typepad which, to my knowledge, hasn't been replicated by any other hosting system is that I could create multiple blogs, each connected to a unique domain name, for the same modest hosting price.

I've been using Typepad for more than two decades now and it was familiar and reliable, if increasingly clunky in this era. It was sobering archiving a lot of old material and rediscovering many blogs that I had created but only barely started, or never started.

One of the things that "saved the day" was Internet Archive's Wayback Machine and the Save Page Now (to Wayback Machine) option, which I made extensive use of. I know there are other, more efficient options to do this such as browser extensions, but I was under a hard deadline (and sure enough, Typepad shut down approximately 21:00 on 2025-09-30). In my last minute archiving, I didn't want to mess with potentially fussy options such as browser extensions, and wanted assurance that something I wanted saved into Wayback Machine *did* make it.

This experience, brought home, viscerally, how important Internet Archive and especially Wayback Machine is to modern online life. After the first hour of that work, I set up a recurring monthly donation to Internet Archive, and will probably continue those monthly contributions to IA for the rest of my life.

I understand how weird this sounds, but I miss good old Typepad. It was a constant in my online life to have a reliable go-to option for saving and hosting files, popping off a quick blog post, etc. I get that it must have become increasingly problematic to maintain all that Typepad infrastructure, a business structure of a fading system, and the problems of finding personnel willing to maintain a legacy system…

but I really do miss good, old, reliable Typepad.

Great Minds…

Often think alike. In this issue I wrote my article **How To Get (Re) Started In Amateur Radio Data Communications** pretty much from scratch to answer a plaint that I've often seen expressed by those coming into, or coming back into Amateur Radio wanting to get started / restarted with data communications.

After I finished that article, it was time to add the other content, and I remembered that I had an article in the queue from Zero Retries Pseudostaffer and long time Amateur Radio friend and co-conspirator, Don Rotolo N2IRZ.

After I added Don's article and proofread it, wow, much of it was on the same topic as *my* article, how to start, or restart an Amateur Radio data communications network / system.

If you enjoyed N2IRZ's article, please get in touch with him to let him know and encourage him to write more (and not necessarily just for Zero Retries, although that's always appreciated and enjoyed).

Still Working on ZRDC 2025 Archives

I still have a fair amount of archiving to do for ZRDC 2025, which I'll be working on next week during my travel "downtime". I'm grateful to Kay Savetz K6KJN for volunteering to do the editing of the ZRDC 2025 video stream. ZRDC 2025 attendees, presenters, and those who paid for early access to the videos should have received an email about that. We plan to publicly release the videos of ZRDC soon. I really want to finish out ZRDC 2025 by providing a pretty comprehensive record of the presentations and all other relevant material.

Weekends Are For Amateur Radio!

Well, *kind of* for Amateur Radio this weekend.

If it weren't for our planned departure for the two day car trip to San Ramon, California and Pacificon 2025, I probably attend Interim Computer Festival 2025 in Seattle. This is a conference for retrocomputing, and would be a lot of fun.

Yeah, I could probably cram in both ICF 2025 and trip preparations, but Zero Retries will have a vendor table at Pacificon 2025 and that requires preparing some handouts and other table material, some equipment (for displaying a slide deck), and other preparations. Tina and I agree that we'd rather use more prep time to avoid feeling rushed, and be able to leave early, to have a more relaxed trip.

Have a great weekend, all of you co-conspirators in Zero Retries Interesting Amateur Radio activities!

Steve N8GNJ

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VHF-UHF Packet Path Predictions

Don Rotolo N2IRZ

One useful resource when building a Packet network on VHF/UHF is the ability to predict which RF paths are feasible and, for those that aren't, why not. I'm not going to get into the deep details now, instead deliver a basic introduction to the tools we use.

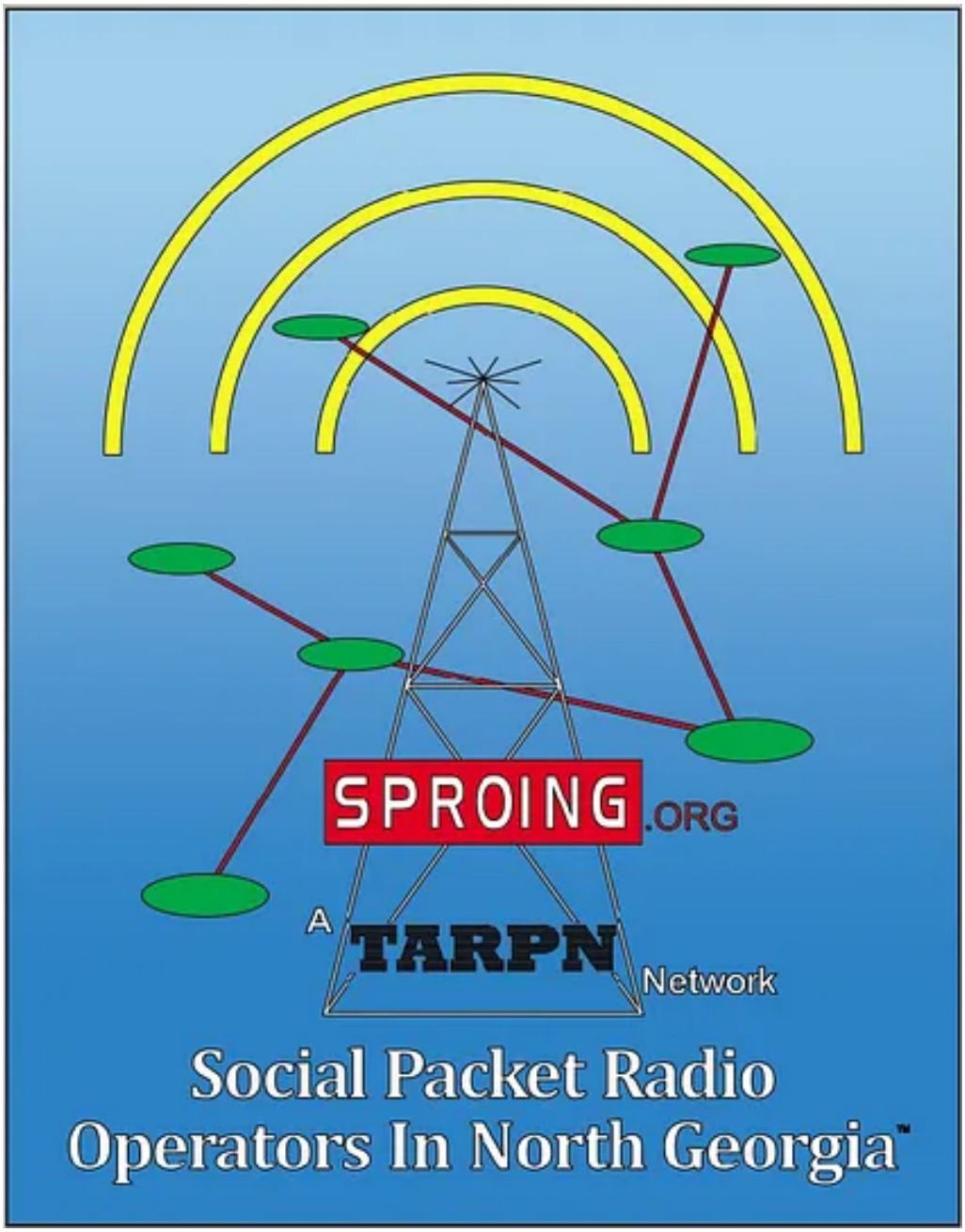

Image courtesy of Don Rotolo N2IRZ

You've seen TARPN (Terrestrial Amateur Radio Packet Network) mentioned here before, and you can get all the details at tarpn.net, but the short point is that I'm working to build a TARPN here in Atlanta [Georgia, USA] - Social Packet Radio Operators in North Georgia - SPROING. After a year of trying and some significant setbacks it's still a slog, yet slowly but surely we're gaining traction.

When we identify a new participant, one of the first things we do is plot the RF path to any nodes that might be in range using Roger Coudet VE2DBE's Radio Mobile Online (RMO) tool https://www.ve2dbe.com/english1.html. There is a brief learning curve, but basically we define the Sites, then analyze the Link between them. While RMO can also create coverage plots, which offer a good overview of a site's potential, we have not found them as useful as the Link tool.

For each potential Link, we use a standard set of parameters, such as antenna height and gain, feedline loss, receive threshold (uV) and

others, select the frequency of interest and create a Link Study. The most important parameter calculated from this is the Total Path Loss (TPL). In practice a TPL of 140 dB or less is very good, with smaller numbers being better, since in my experience we can overcome that loss with modest power and antenna gain.

Interesting is that the only parameters affecting TPL (for a given terrain between stations) are antenna height (higher is better) and RF frequency (lower is better). Values such as transmit power, line loss, antenna gain and receive sensitivity don't affect TPL, but can be manipulated to better overcome the TPL and ensure sufficient fade margin.

Although RMO has several maps available to show the link or station coverage, we instead use Google Earth Pro (locally installed, not the web version) to visualize the path and terrain along the link, as well as identifying amateur stations that might be in a (physical) position to help us create a link that would be otherwise difficult to impossible by overlaying the coverage plot of two stations. Where they intersect will be a good place for an intermediate station that splits the required link into two easier hops.

Sure, contacting a random ham and asking them to put up some equipment for packet is a bit audacious, but surprisingly I've seen it work. That's typically outside my comfort zone, but the worst possibility is they say no. But if they happen to be a member of the same club, and you see them at a meeting…

If you're interested in the details, my contact info on QRZ.net is valid. But get yourself a (free) account at Radio Mobile Online first, then play with it to shorten that learning curve.

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Why Should You Consider Joining The TPRFN Network

By Glenn Allison N3MEL

Editor's Note *- This was originally published on the packet-radio-rf-forwarding email list. This article was lightly edited for the vagaries of publishing in a Substack newsletter.*

The **TPRFN (The Packet Radio Forwarding Network)** is a significant development for amateur radio operators, particularly in the realm of digital communications and emergency preparedness.

The importance of joining the TPRFN network centers on its core mission: **to create an RF backbone for the Packet Radio Network** but soon grow into **a robust, reliable, and internet-independent digital messaging system for amateur radio.**

Here are the key reasons why participation in the TPRFN network is valuable:

1. Enhanced Emergency Communications (EMCOMMs)

- **Internet Independence:** The primary goal of TPRFN is to move away from using the internet for forwarding digital messages such as (AX.25, NTS, WL2K & APRS). By utilizing **RF-only links**, primarily on the HF bands using modes like **VARA HF** and **ARDOP**, making the network resilient to infrastructure failures. In a major disaster where phone, cell, and internet systems are down, TPRFN provides a vital, wide-area messaging backbone.
- **Packet Radio Modernization:** It revitalizes and modernizes traditional packet radio by linking existing VHF/UHF packet networks together using robust, newer digital HF modes. This creates a larger, more dependable footprint for local and regional message traffic.
- **Long-Distance Reliability:** The use of **NVIS (Near Vertical Incidence Skywave)** propagation on HF bands allows for consistent, reliable communication over hundreds of miles, even when long-haul DX is not possible. This is ideal for connecting regional EMCOMMs centers that are too far for VHF/UHF but still require local or state-wide message forwarding. This does however require additional dedicated fill in stations.

2. Digital Traffic Capability and Diversity

- **Bridging Networks:** TPRFN acts as a crucial bridge, linking various existing packet radio systems (BPQ, JNOS, Flexnet, etc) across long distances, ensuring that messages can flow between different packet systems.
- **Faster and More Efficient Digital Modes:** By leveraging modern digital modes like VARA HF, the network can achieve significantly faster data rates than older 300 baud AX.25 links, making the movement of large messages much more efficient.
- **Support for Multiple Services:** The network is actively working on further integrating services like **Packet Node/BBS, Winlink & APRS SMS and Email messaging**, expanding its utility beyond simple BBS forwarding to offer versatile communication options in the field.

3. Training and Skill Development

- **Hands-On Digital Experience:** Using the TPRFN Network encourages amateur radio operators to develop expertise in digital modes, networking platforms like (BPQ32, AREDN, 44net, etc.), and HF propagation—skills that are critical for effective EMCOMMs deployment.

- **Real-World Practice:** Participating in the network's day-to-day operation and planned exercises (like the monthly PKTNET & local events like the EPA ARES Fall S.E.T.) provides valuable, continuous practice for handling and forwarding digital traffic under conditions that simulate a true emergency.

4. Expansion and Community

- **Network Growth:** Every station that joins the TPRFN Network strengthens the overall network's reach and redundancy. More nodes create more forwarding paths, making the system more robust and ensuring that a message has a higher chance of reaching its destination.

- **Collaborative Environment:** The network fosters a community of operators dedicated to pushing the boundaries of digital amateur radio, sharing knowledge, and preparing their communities for potential communication outages.

- For additional information about the network see our website at: tprfn.net or use our "Contact Us" form at:www.tprfn.net/contact-us

- To view the current network stations: www.tprfn.net/network-map-1 and for look at the current live connection across the network: www.tprfn.net/live-connections

- **Please Consider Joining:** TPRFN offers two types of station participation the biggest need is for the Full-time Hub Station the 2nd is the part-time Polling Station. The website explains in more detail about these types. We are looking to continue building a reliable HF network coast to coast in the US.

Please feel free to share this info with you local ARES/RACES or EMCOMM Groups that are looking to further the reach of their established digital networks. We can also provide assistance if needed for integration options.

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IP400-users - A New Independent Email Support Group for IP400 Network Project

By Steve Stroh N8GNJ

It's a measure of how much potential I continue to see in the technology and ultimate usage within Amateur Radio of the IP400 Network Project that I have decided to establish a new, *independent* email support group for users of IP400 Network Project devices, networks, software, etc.

See https://groups.io/g/ip400-users.

As I've stated a number of times now, I no longer have any direct involvement in the IP400 Network Project. With these, and some previous developments which I won't disclose publicly, to be very, abundantly, transparent…

*I no longer have **any** involvement - as in none at all, with the IP400 Network Project.*

I am merely an observer, and potential user of IP400 Network Project.

This was necessitated (in my opinion) by the "hostile takeover" and announced shutdown of the ip400@groups.io email list. I was formerly an "Owner" (and thus administrator) of that group, but that status was removed (without consultation or agreement). Zero Retries has been the financial supporter of the ip400 email list for some time now (now corrected thanks to groups.io support).

I confess I don't understand the thinking of the principals of the IP400 and Alberta Digital Radio Communications Society as to their "lock it down, *we totally control the messaging*" philosophy of promotion and support of IP400.

But, it's an old tradition on the Internet… *censorship is treated like damage and is simply routed around.*

My establishment of the ip400-users email list is my "route around" for continued, independent discussion of IP400 via email.

This is one of the reasons that Zero Retries is an entirely independent publication, that I'm able to speak truth as I see it.

And to answer a significant discussion point about email lists being an old, tired, online discussion method that has fallen out of favor versus "constantly online chat" systems such as Discord… point taken. But in my observation, there are enough of us that prefer asynchronous discussion systems such as email lists, that there was reasonable utility in establishing this new email group to enable independent discussion about IP400 Network Project.

I look forward to chatting with other IP400 Network Project fans on ip400-users.

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How To Get (Re) Started In Amateur Radio Data Communications

By Steve Stroh N8GNJ

A recurring theme I see on various discussion groups about Amateur Radio data communications is someone who used to be active in Amateur Radio data communications (usually, Packet Radio), often, decades ago, and wants to resume being active in Amateur Radio data communications.

Generally the request is to establish or re-establish local Amateur Radio data communications networks to communicate with like-minded Amateur Radio Operators that are located in the same area.

Motivations for their resurgent interest in Amateur Radio data communications vary widely, as do their expectations. There's no one, good, guide to the various options for Amateur Radio data communications in 2025 and beyond, so I thought I'd offer some general, high-level guidelines.

This article does not discuss Amateur Radio Over Internet (AROI) systems such as accessing repeater networks via Internet. If AROI is of interest, I recommend The Random Wire Newsletter by Tom Salzer KJ7T which provides excellent coverage of AROI and related topics.

This article also doesn't discuss some promising, but still nascent Amateur Radio data communications systems such as IP400 Network Project, MMDVM-TNC, and my SuperPeater concept.

What Not To Do - Legacy 1200 bps AFSK Packet Radio, Digipeaters, and Radios With Built in TNCs

I am a lover and a fan of legacy 1200 bps AFSK Packet Radio… but I really don't recommend using legacy packet radio as a starting point for Amateur Radio data communications in this era. Decades ago, 1200 bps AX.25 Packet Radio using Audio Frequency Shift Keying (AFSK), using legacy Terminal Node Controller (TNC) units such as the Kantronics KPC-3, was the best most users could do. 1200 bps AFSK works because you can connect a TNC a typical VHF / UHF FM radio's microphone and speaker connections and transmit data.

But doing so is generally not that satisfying an experience in 2025 because of the slow data speeds and it being error prone (many retries) and often frustrating to use. We can do better in 2025, which I'll discuss below.

Very briefly, while Packet Radio digipeaters (typically 1200 bps) can be used for creating networks, data communications use (longer packets for exchanging emails, file transfers, etc.) can quickly saturate a digipeater, and thus result in an unsatisfying experience.

Similarly, it's been widely observed that the radios which incorporate "TNCs" are generally usable only for short packets used for Automatic Packet Reporting System (APRS) communications. Like digipeaters, built-in TNCs can quickly get overwhelmed by exchanging emails, file transfers, etc.

QO-100 - Amateur Radio Payload in Geosynchronous Orbit Above the Eastern Hemisphere

If you're an Amateur Radio Operator located in the Eastern Hemisphere and want to communicate with like minded Amateur Radio Operators also in the Eastern Hemisphere, I recommend setting up a station to use the QO-100 Amateur Radio payload. It's easy (enough - one can buy turnkey equipment if desired), capable, and from all accounts, a lot of fun. Given QO-100's hemispheric coverage, you're not limited to communicating only with folks in direct VHF / UHF / Microwave range from your station using terrestrial antennas.

Most Modern Amateur Radio Data Communications Experience - AREDN

AREDN is essentially Internet technology adapted for some of the unique aspects and requirements of Amateur Radio and used on Amateur Radio microwave spectrum. Two examples of adaptation for Amateur Radio is the use of callsigns for identifying AREDN nodes, and explicit lack of encryption on AREDN networks.

If you have an AREDN network in your area, or are willing to start one, AREDN offers fast data communications, native TCP/IP compatibility, and relatively easy network building (automatic and dynamic mesh networking) and administration.

Like commercial Internet, AREDN provides full duplex (or, close enough) communications and low latency. Because of the speed and native TCP/IP (IPv4) capability, almost any typical Internet systems (that can be locally hosted on an AREDN network) will work over AREDN, such as sharing high resolution video cameras, Voice Over Internet Protocol (VOIP) telephones, web servers / clients, email servers / clients, etc. I have not heard of video chat systems such as Zoom in use over AREDN networks, but I'll guess that such

systems exist.

Thus, AREDN being the most “modern” Amateur Radio data communications system, is the preferred method of Amateur Radio data communications for many.

There is also the option of building private microwave networks using “stock” outdoor Wi-Fi and Wireless Internet Service Provider (WISP) units (not running AREDN software), which has the benefit of being able to use encryption, use for commercial content, etc.

In 2025, AREDN was significantly improved by the conversion of the mesh networking technology to a new system called Babel, which has much lower network overhead than the previous mesh networking technology. Also in 2025, the graphical user interface of AREDN units, much more informative for average AREDN users, was significantly improved.

In addition, AREDN now supports the use of some 802.11ah (Wi-Fi HaLow) units which operate on 902-928 MHz (in North America) which is more suitable for localized mesh networks than the more common AREDN units operating on 5 GHz.

New Packet Radio

Despite the name, New Packet Radio (NPR) has no commonality with legacy Amateur Radio Packet Radio. Unlike AREDN, NPR operates on the Amateur Radio 420-450 MHz band, requiring a minimum 100 kHz channel (for 100 kbps raw throughput), and up to a 1 MHz channel for 1 Mbps raw throughput). Like AREDN, NPR supports TCP/IP (IPv4). Thus many Internet technologies and applications can work with NPR, if the technologies and applications are “patient” to allow for the higher latencies inherent in NPR operating half-duplex.

NPR is a bit easier to set up than AREDN because it operates on the Amateur Radio UHF band, thus antennas are easier to aim and paths on UHF are a bit more robust than microwave “must have an optical clear line of sight”.

An ARDC grant in 2024 might make NPR even more capable to operate on the 144-148 MHz and the 1240-1300 MHz Amateur Radio bands.

VARA HF, VARA FM, and VarAC

VARA HF and VARA FM are widely used and supported in Amateur Radio emergency communications systems and networks such as Winlink. VARA FM is rapidly displacing legacy packet radio systems. VARA is largely superior to legacy AX.25 Packet Radio in almost every way other than it is a proprietary system, operating only on Windows PCs, and requires payment of a license fee for full performance.

Because of that close association of VARA FM and VARA HF with emergency communications use, many Amateur Radio Operators think that is the only or primary use of VARA FM and VARA HF… but that’s not the case at all. Like legacy Packet Radio communications, VARA FM and VARA HF can be used casually, individually or in a group without the intent of emergency communications.

A full description of the merits of VARA HF and FM are beyond the scope of this article, but a quick web search will find many good explanations and presentations about setting up and using VARA systems, especially for emergency communications use. On VHF / UHF, VARA FM can be used with a typical VHF / UHF FM radio with typical microphone / speaker connections, and almost any audio interface such as the popular Tigertronics SignaLink USB units. if an optimized radio and audio interface is used, such as a Kenwood TM-D71A and a Masters Communications Digital Radio Adapter, speeds of up to 25 kbps can be achieved using a typical 12.5 kHz VHF / UHF channel.

One impressive capability that differentiates VARA FM significantly from legacy Amateur Radio Packet Radio is that VARA FM “negotiates” between two VARA FM stations for best common speed. For example if a station set up for “VARA NARROW” (maximum data rate 12 kbps) attempts to communicate with a station set up for “VARA WIDE” (maximum data rate 25 kbps), the two stations will negotiate that 12 kbps is the best common speed between those to stations and complete the communication at 12 kbps. Thus both fast (WIDE) and slower (NARROW) VARA FM stations can share the shame channel, unlike legacy Packet Radio 1200 bps and 9600 bps stations, which will don’t recognize the two different types of transmissions.

In addition to the higher speeds possible with VARA FM, VARA FM implements Forward Error Correction for a more robust connection. Thus frustrating retries for single bit errors are largely avoided.

VARA FM can also be used on a conventional FM repeater for implementing a wide area network.

VarAC is a separate, companion application which operates in conjunction with VARA FM or VARA HF, offering email, bulletins, file transfers, text chatting, and many other modern communications capabilities.

For setting up a local data communications system with conventional Amateur Radio VHF / UHF radios, the use of VARA FM and VarAC has a lot to recommend it.

Modern Amateur Radio Packet Radio

Amateur Radio Packet Radio certainly has not gone away in the modern era, and indeed Amateur Radio Packet Radio is more capable than ever… as long as one knows about the more modern, more capable implementations of Amateur Radio Packet Radio.

KISS
The major differentiation between legacy Amateur Radio Packet Radio and modern Amateur Radio Packet Radio is that the latter now use the "KISS" protocol. That is, unlike legacy Packet Radio TNCs, all networking functionality is handled in software operating on a host computer, not in the TNC unit.

Faster Data Speeds
Modern Amateur Radio Packet Radio units can operate at faster data speeds than 1200 bps even with conventional radios. For example, many radios, even when microphone and speaker connections are used, can support data speeds of 2400, 3600, or 4800 bps. 9600 bps and even faster data rates can be used with some combinations of radios (using "flat audio" interfaces) and "high fidelity" audio adapters.

These speeds make Amateur Radio Packet Radio a lot more usable than 1200 bps data rates. Some legacy Amateur Radio Packet Radio TNCs supported those data rates, but were implemented with hardware modems which were (in a word) very "fussy" and overall weren't all that usable in real world conditions.

Forward Error Correction
One of the biggest changes in modern Amateur Radio Packet Radio is the addition of Forward Error Correction (FEC). There are two FEC systems in use for Amateur Radio Packet Radio - FX.25 and IL2P. FEC makes Amateur Radio Packet Radio to be far more usable as single bit errors can be fixed without requiring a retransmission of an entire packet. This makes 9600 bps Amateur Radio Packet Radio actually usable in real world conditions.

Terrestrial Amateur Packet Radio Network - TARPN
TARPN is a mature "specification" of an Amateur Radio data communications network. The NinoTNC (see below) was developed as (but not limited to) the primary data communications interface for stations in a TARPN. TARPN has developed, and documented all the elements necessary to create a TARPN.

Dire Wolf
The Dire Wolf Software TNC incorporates all of the aspects of modern Amateur Radio Packet Radio. One of the most significant improvements that Dire Wolf implements in Amateur Radio Packet Radio is a unique automatic, internal correction for many / most single bit errors. When Dire Wolf receives a packet with a Cyclic Redundancy Check (CRC) error, it implements a unique "big flipping" technique that selectively, intelligently "flips" most of the bits in a packet and then tests to see if as a result of that single bit flip, the CRC error is fixed. This one technique dramatically improves the overall reliability of Amateur Radio Packet Radio communications when Dire Wolf is used.

Beyond its incorporation of "big flipping error correction, Dire Wolf is open source software, and is thus embedded in a number of Amateur Radio Packet Radio systems (see below). Dire Wolf provides a KISS interface, faster data speeds, and both FX.25 and IL2P FEC. It's typical to use Dire Wolf on a modest Raspberry Pi computer, including the Raspberry Pi Zero 2 W.

JNOS
JNOS is multifunction software that, among other capabilities, can act as a router between Amateur Radio Packet Radio (AX.25) and TCP/IP. For example, it's possible to use a conventional Internet email application to send and receive email via Amateur Radio Packet Radio because JNOS can provide a SMTP and POP interface that Internet email applications require.

JNOS also incorporates Net/ROM Amateur Radio Packet Radio mesh networking. Over the decades, JNOS has grown increasingly capable and can be used to create very capable Amateur Radio Packet Radio networks with multiple nodes, bands, interfaces, etc.

BBS
Amateur Radio Packet Radio Bulletin Board Systems (PBBS) are becoming increasingly popular again as a "water hole" for asynchronous communications amongst small groups of Amateur Radio Operators. The most popular and capable PBBS is G8BPQ Mail Server.

It's just kind of fun to use a PBBS in this era, especially when you can access it at higher speeds and reliability possible with modern Amateur Radio Packet Radio and VARA FM (which offers a KISS interface).

NinoTNC
The NinoTNC is a modern TNC as described above, providing a KISS interface, higher speeds, and IL2P FEC. It is offered in both kit and assembled versions.

TNC4
The Mobilinkd TNC4 is another modern TNC which provides a KISS interface and 1200 bps / 9600 bps data speeds. It does not offer Forward Error Correction. To support its intended use with portable radios, the TNC4 has an internal battery, and can be connected to the host computer via Bluetooth.

DigiPi
DigiPi is a combination of integrated Amateur Radio Packet Radio software and hardware, with several options for the hardware. A unique aspect of DigiPi is that it is designed to be operated remotely on a computer, tablet, or even phone using a web browser. Thus DigiPi can be set up in an unobtrusive location and then operated via the household Wi-Fi network (DigiPi does not require Internet

access). DigiPi uses the Dire Wolf Software TNC, and offers a number of optional other Amateur Radio data communications capabilities.

WINTNC
If you do end up using a legacy Amateur Radio Packet Radio TNC, it's sometimes maddening to get it set up using a typical dumb terminal application connected to the TNC via RS-232, especially if the state (*working? not working?*) of the TNC is unknown (like most of mine sitting in storage for years).

Thus WINTNC would probably be helpful as an application that is specifically designed to connect to TNCs might be helpful.

The author of WINTNC is now working to port WINTNC to Linux and a version specifically for Raspberry Pi.

…

If you have suggestions for additional systems that should be included in a future versions of this article (and sections in my upcoming book, the Zero Retries Guide to Amateur Radio in the 21st Century), please let me know.

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By Steve Stroh N8GNJ

Short mentions of Zero Retries Interesting items.

The Wow@Home Radio Telescope

> A **network of small radio telescopes** offers several distinct advantages compared to large professional observatories. These systems are low-cost and can operate autonomously around the clock, making them ideal for continuous monitoring of transient events or long-duration signals that professional telescopes cannot commit to observing full-time.
>
> Their geographic distribution enables global sky coverage and coordinated observations across different time zones, which is especially valuable for **validating repeating or time-variable signals**. Coincidence detection across multiple stations helps **reject local radio frequency interference (RFI)**, increasing confidence in true astrophysical or technosignature transient events.
>
> These networks are also highly scalable, resilient to single-point failures, and capable of **rapid response to external alerts**. Furthermore, they are cost-effective, engaging, and accessible, **ideal for education, citizen science, and expanding participation in radio astronomy**.
>
> However, these systems also come with notable limitations when compared to professional telescopes. They have **significantly lower sensitivity**, limiting their ability to detect faint or distant sources. Their angular resolution is poor due to smaller dish sizes and wide beamwidths, making **precise source localization difficult**.
>
> **Calibration can be inconsistent across stations**, and frequency stability or dynamic range may not match the performance of professional-grade equipment. Additionally, without standardized equipment and protocols, data quality and interoperability can vary across the network.
>
> Despite these constraints, when thoughtfully coordinated, such networks can **provide valuable complementary observations to professional facilities**.
>
> …
>
> *We are still testing both the hardware and software. Hardware testing has been delayed due to a shortage of a key component, the LNA, which is expected to be back in stock by September 2025. Here is a list of the hardware components. We recently found that the Wow! Signal was strong enough that even small telescopes could potentially detect similar signals.*

I love to feature projects like Wow@Home, HamSCI, SatNOGS, TinyGS, ARISS, and others that allow a techie individual with some knowledge of… or just interest in radio technology to contribute in some small way to science knowledge and research and science education.

STARS-Me2 CubeSat Data Communications Experiment

From ANS-257 AMSAT News Service Bulletins:

> **STARS-Me2**, a 1U CubeSat built by Shizuoka University features an earth observation camera, but the real experimentation takes place on the AX.25 radio downlinks on which those photos are transmitted back to earth. Reception success rates at receiving ground stations will be measured at baud rates of 1.2kbps, 9.6kbps and 115.2kbps. The coding gain of the error correction scheme will be measured on the downlinks. And the reception performance with polarization diversity at multiple terrestrial receiver stations (developed by amateur radio operators) will be evaluated. The goal is to learn more about how large data sets, such as images, are best transmitted from space. UHF downlinks with CW, 1k2 AFSK, 9k6 FSK and 115.2 bps GMSK are coordinated for 437.350 MHz, 437.400 MHz and 437.200 MHz.

Sounds like a Zero Retries Interesting space activity!

I found this page with a little bit of detail - STARS-Me2 Overview (English).

The latest entry in the log on that page is:

> ◆2025/09/19: Deployed from the ISS.

ARDC Kicks off YouTube Channel with 44Net Origin Story

Rebecca Key KO4KVG on the ARDC website:

> We're excited to share that we are now on YouTube! Our channel will be a place where we highlight information about our programs, along with relevant how-to guides, and other content that supports our mission.
>
> To kick things off, in continuing our celebration of 44 years of 44Net, we invite you to check out our first video, which looks back at where it all began:
>
> If you'd like to see more videos about 44Net or learn about our grantees, be sure to subscribe so you don't miss out on future updates!
>
> If you're interested in exploring some of our earlier videos, you can still find them on our Vimeo channel: https://vimeo.com/ardc73.

The referenced video is well done, tightly edited, and really gives a flavor of those who were in there at the beginning of 44Net.

Kudos to ARDC!

The DARPA Packet Radio Network Protocols

1987 paper recently added to Digital Library of Amateur Radio & Communications:

> In this paper we describe the current state of the DARPA packet radio network. Fully automated algorithms and protocols to organize, control, maintain, and move traffic through the packet radio network have been designed, implemented, and tested. By means of protocols, networks of about 50 packet radios with some degree of nodal mobility can be organized and maintained under a fully distributed mode of control. We have described the algorithms and illustrated how the PRNET provides highly reliable network transport and datagram service, by dynamically determining optimal routes, effectively

> controlling congestion, and fairly allocating the channel in the face of changing link conditions, mobility, and varying traffic loads.

Wouldn't it be… cool… to recreate DARPA Packet Radio Network, AlohaNet, etc. using modern technology, in Amateur Radio?

GRF5604 RF amplifier boards are now available at PCBWay

Wojciech Kaczmarski SP5WWP writing on the M17 Project website:

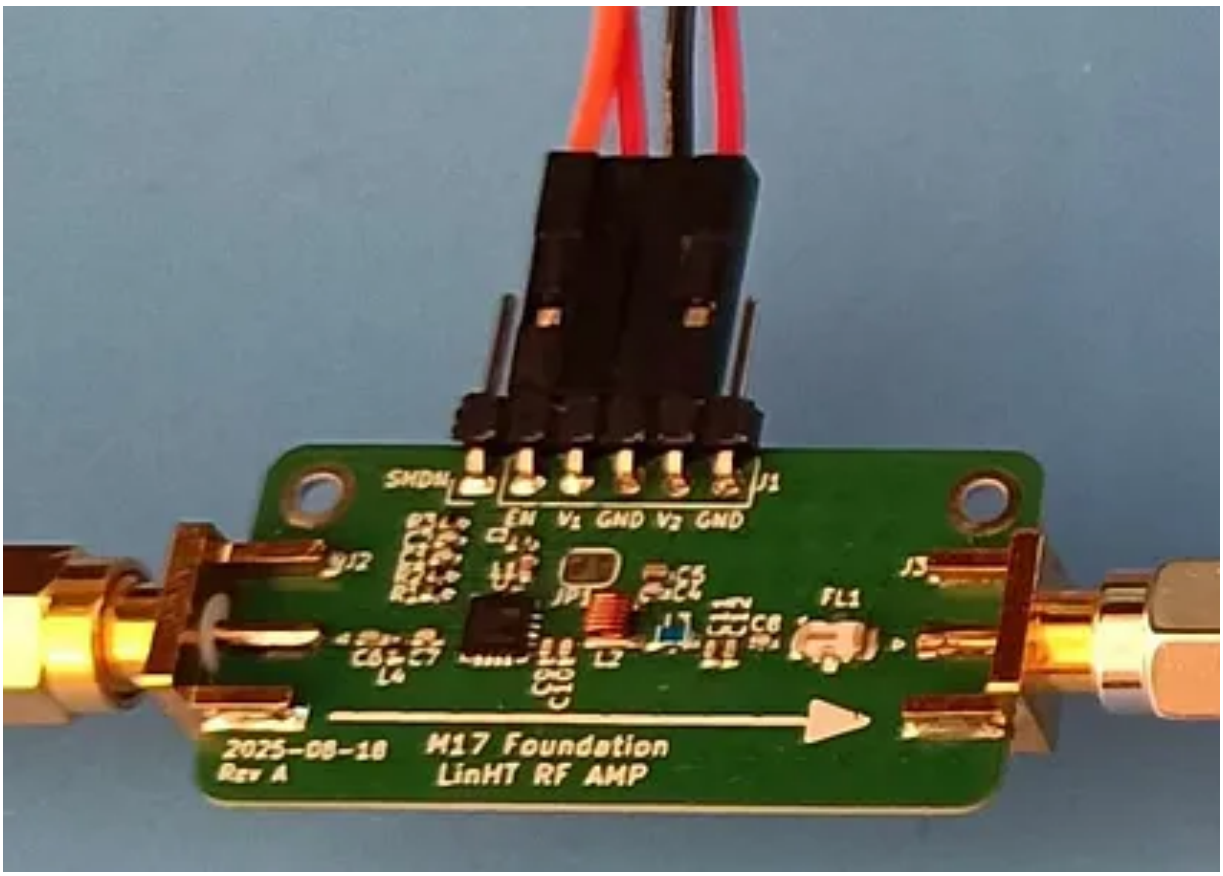

Image courtesy of Wojciech Kaczmarski SP5WWP / PCBWay

> We designed a universal amplifier block for the 70cm band, that can be used with virtually any mode out there (including M17, of course). Thanks to GRF5604's good linearity, high PAPR modulations, including SSB, QAM, and OFDM, shouldn't cause much trouble.
>
> The board should be supplied with 5V. Maximum useful power output (CW) is about 6W. See the chip's datasheet for more details.
>
> **Note**: an adequate heat sink is required. The boards do not come with SMA connectors. PCB's thickness is 1mm. Output lowpass filter is included.
>
> Our "Shared Project": https://www.pcbway.com/project/shareproject/LinHT_RF_amplifier_ff94e9ca.html
>
> Enjoy!

I suspect that "shared project" refers to the use of this board in the "outdoor node" IP400 Network Project unit.

Between sourcing the SMA connectors, the four (or six?) pin connector, and the heat sink (illustration needed), this would be a bit of a project, but the payoff is that this would take the (very low) output of a Software Defined Transceiver up to perhaps as much as five watts of transmit power. This is a great start, and perhaps an "entrepreneurial someone" in the US can get these "starter kits" into the US somehow (given they're made in China) and, add the missing pieces, and make usable plug and play turnkey units available for a reasonable price.

Review: futureGEO Workshop 2025 in Bochum

AMSAT-DL website / blog:

> **Setting the course for the next geostationary amateur radio satellite**
>
> On September 19, 2025, the futureGEO workshop took place under the radome of the Bochum Observatory. Organized by AMSAT-DL with the support of ESA, the event brought together international experts, representatives of amateur radio organizations and dedicated radio amateurs who had previously declared their active participation in an appeal and submitted corresponding proposals. In the spring, AMSAT-DL had invited potential interested parties as part of an RFEI. The aim was to build on the experience gained with QO-100 and to jointly define the first concrete mission ideas for a future amateur radio payload in geostationary orbit.
>
> At the opening, Peter Gülzow recalled the history of QO-100's development: the satellite was not simply a "re-tuned" commercial transponder, but largely customized technology. This experience – and also the limits of construction and operation – are now shaping the plans for a possible successor. ESA representative Frank Zeppenfeldt confirmed that there is great interest on the European side in a new GEO amateur project. Funds for further studies and prototypes could be made available in the next project phase. There is no GEO slot yet and hosting opportunities are hard to come by, but one or more ready-made concepts could significantly increase the chances of a flight in the future as soon as an opportunity arises.
>
> …
>
> **Review and outlook**
>
> In a concluding reflection among the participants, it became clear how much QO-100 has revitalized and enriched the amateur radio community:
>
> - Affordable entry into microwave communication with low-cost SDRs and LNBs.
> - Development of open source software such as DVB-S2 encoders and decoders.
> - Educational projects from schools to school contacts with Antarctica and other events.
>
> The participants hope that radio amateurs can be even more involved in the construction of the hardware of a futureGEO with appropriate personal contribution, transparency and participation than was possible with QO-100 due to NDAs with the manufacturers and owners of the parent satellite.
>
> The participants also thanked the moderator and the organizers from AMSAT-DL and the Bochum Observatory, especially Nicole Sehrig, for the professional conduct of the workshop. Special thanks also went to Jens Schoon DH6BB for the video and sound technology on site, so that the online participants could also be involved in the discussions and elaborations.
>
> The respective photo documentation and further information are available transparently in our "futureGEO" GitLab repository.
>
> The next steps are clear: The mission ideas developed in the workshop will be further concretized and should be available by the end of 2025 in the form of 1-3 consolidated mission concepts that are both technically exciting and attractive to the international amateur radio community and must also be technically feasible.

This reads as a reasonably complete overview of this event. Notably, this article is published in public, *not behind a paywall* and by doing so, AMSAT-DL is explaining to the public about its activities and especially interesting, relevant activities such as actively working towards a new GEO payload / satellite for Amateur Radio.

From this, AMSAT-DL seems like the single Amateur Radio space-related organization with some reasonable momentum to develop another Amateur Radio GEO payload / satellite. Given that AMSAT-DL is doing Zero Retries Interesting activities like this (not to mention day to day management of QO-100), the annual membership rate of €120 doesn't seem too daunting, and membership in AMSAT-DL is worth considering.

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Comments Summary From Previous Issue

Comments from Zero Retries 0221:

- Polar Modulation isn't a new *idea*… just two new implementations in 2025
- Excitement about the CentyLabs PocketPD

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These bits were handcrafted (by a mere human, not an Artificial Intelligence bot) in beautiful Bellingham (The City of Subdued Excitement), Washington, USA, and linked to the Internet via **Starlink *Satellite* Internet Access**.

See the **Zero Retries Boilerplate** page for significant acknowledgements and other information relevant to Zero Retries. For new readers of Zero Retries, that page, and the **About Zero Retries** page has useful information to check out.

My ongoing ***Thanks*** to:
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*Keywords in **Bold** are regular mentions in each issue.*

the end…